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Sharing video making objects to create, reflect & learn

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Abstract. Creative performance through participative video making is a means to engage students in science, technology, engineering, and mathematics (STEM) subjects, arousing the curiosity of learners and their audience. This paper focusses on the role of video creation artefacts as boundary objects stimulating reflection and deeper understanding. Based on this theory we explain how engaging students in a video making supports enhanced reflection and understanding of specific topics of study.

Keywords: performance; orchestration; participative video; juxtapose; learning; boundary object; STEM; creativity; storyboards

1 Introduction

Young people are insufficiently motivated to take science, technology, engineering and math (STEM) subjects at school or university [1]. Intrinsic motivation is created through a desire to know and to have an interest in something. The EU project Juxta-Learn aims to foster interest in different STEM subjects by stimulating curiosity and supporting learners through performative and productive activities. Students' performance is substantiated in the form of creative, participatory video making and editing, together with sharing and commenting of videos in a learning community.

Participatory video (PV) involves a process in which participants are asked to juxtapose standard interpretations with playing with concepts, exploring them creatively [1] and learning in groups. PV provides a medium in which to provoke conflict that facilitates learning [2] by drawing students' attention to discrepancies and opposing viewpoints between their different interpretations of the topic. A participative approach allows the students to demonstrate and develop their learning in groups, an iterative process [3] that requires "handing over agency" to the participants. Video-as-production-process allows reflection and generates knowledge [4], provoking reflection on behavior [5,6] This encourages iterations between performance and editing activities as students clarify shared understanding, and as the teacher advises them.

Through reflective listening students listen and restate in order to identify and clarify differences, iterating over the stages three to five (interpret, perform and compose) of the JuxtaLearn process (cf. **Fig. 1**).

The whole learning pathway is orchestrated into eight stages (cf. **Fig. 1**) stages: (1) teacher identifies a subject, (2) teacher demonstrates a standard teaching activity (STA), (3) students interpret the STA in groups, (4) students perform and create a video, (5) students compose the final video, (6) students share the video, (7) students discuss the videos, (8) students review in the class. In this paper, we will focus on stage 4 (cf. **Fig. 1**) of the JuxtaLearn process.



Fig. 1. Steps of the JuxtaLearn process

2 Objects for performance

Objects that are shared and sharable across different key parties are known as boundary objects (BO) [7,8,9] and can help solve problems in a context where diverse groups of people work or study. Boundary objects are important to how language emerges when people do things together. Boundary objects and their representations coordinate by providing information; they also provide a form of shared reference point around which people interact and create shared meaning. In this sense they “inhabit” several intersecting social worlds and satisfy the information requirement of each of them [8,9].

Communication across boundaries is difficult because of the problems of “knowledge in practice”[7], which is knowledge that is “localised, embedded and invested in practice”. We try to identify these boundaries in the JuxtaLearn process and suggest how we can support knowledge transfer at these boundaries.

In general, knowledge transfers over three types of knowledge boundaries [7]: syntactic boundaries, semantic boundaries and pragmatic boundaries.

- A **syntactic boundary** is based on existence of a shared and sufficient syntax at a boundary.
- A **semantic boundary** recognizes that differences exist or emerge, so individuals have different interpretations of a word or event
- A **pragmatic boundary** recognizes that "differences in knowledge are not always adequately specified as differences in degree or interpretation, but that knowledge is localized, embedded, and invested in practice."

At syntactic boundaries, knowledge is transferred; at semantic boundaries, knowledge is translated; and at pragmatic boundaries, knowledge is transformed [10].

A syntactic boundary transfer allows accurate communication using agreed terminology. A semantic boundary advances a step further by harmonizing differences caused by individual interpretations. For instance, a student might describe a scientific concept in a way that a teacher needs to correct the description so that it describes *exactly* what is meant. A pragmatic boundary relates the practical and the philosophical approach of pragmatism, aiming at problem solving, predicting and acting – thus dealing with the negative consequences that arise through difference and novelty.

Collaborative (learning) processes require that syntactic, semantic and pragmatic boundaries are crossed. Each of these types of boundary can be crossed with the help of a boundary object that provides bridges over knowledge thresholds.

Boundary objects need to be tangible, associable (to allow creativity), mutable (to allow crossing of knowledge boundaries), traceable and analyzable (to allow experimenting with knowing) [11]. Finally, a boundary object has to afford opportunities for interaction.

2.1 Storyboards & performance scripts

Important objects integral to the video making process are storyboards and video scripts. Storyboards and video scripts are potential boundary objects that allow knowledge transfer between students creating a film. A storyboard is a set of drawings that are a representation of a film in sequence and can contain elements such as a dialogue. The creation of storyboards is a creative process in which the students collaborate. When they have identified the key elements, they create a video script. A script is a written account of a film containing scenes, dialogue, location, actions and actors, a means to establish the direction of the film. A video script establishes a way the performance should develop.

We contend that video-making storyboards and scripts are boundary objects. The storyboard that the students create is a shared boundary object that requires them to negotiate meaning as they agree the cartoons or pictures that they draw on it, and the text that they include. It helps the students to cross a syntactic boundary and create a shared language that allows them to specify and share perspectives.

At the semantic boundary storyboards enable different conversations [11]. The boundary object has to be visual, accessible and interactive if it is going to be valuable in increasing students' understandings and help them learn. The students' creation of the storyboard helps them identify and argue out shared meanings, negotiating

meaning until and if they eventually agree. By resolving their conflicts through negotiation and discussion the storyboard or video script help the students to cross pragmatic boundaries. Table 1 summarizes the boundaries, mediating objects and purpose within the JuxtaLearn process.

Table 1. BO roles and effects at boundaries – based on Carlile [7,10]

Type of boundary faced	Boundary object role	JuxtaLearn boundary objects	Boundary object influences on JuxtaLearn process
Syntactic Boundary	Shared language creation	<i>Storyboard</i>	Students create their own, but shared language trying to communicate their individual understanding of the STA with each other.
Semantic boundary	Knowledge is translated	<i>Storyboard</i> and <i>script</i> work at the Perform step, and again at the JuxtaLearn Compose and Discuss steps.	Students, whilst practicing the shared language, create shared meanings
Pragmatic boundary	Knowledge is transformed	<i>Video script</i> , with teacher intervention to reduce conflict, guide students & draw their attention to TC. The Compose process works on the <i>unfinished video product</i> with reference to the <i>storyboard</i> .	Students and teacher develop common interests and may create new interpretations.

2.2 Supporting creative performance

While students are planning for and working on their specific video performance, the teachers have to help all groups to work productively, i.e. coordinating students where necessary, helping with topic related questions and keeping them motivated and engaged. One support mechanism for this part is to provide awareness tools that help the teachers to keep informed about the progress of the students like a dashboard showing the progress of each group (cf. Fig. 2) with respect to the JuxtaLearn learning process. With respect to best practices for stimulating creativity and engagement we refer to and adapt common creativity techniques like “gallery walk” (see <http://serc.carleton.edu/introgeo/gallerywalk/how.html>).

The storyboard is a crucial support tool for the students. It structures the student’s work (and learning) by acting as a road map to help students create a shared language, providing a solid foundation on which to place the components of the video. It is a structure for the working out of ideas and the overall visual design of a video.

The JuxtaLearn project uses a storyboard (see Fig. 3) with three columns. The central column contains the cells where students sketch their ideas, and dialogue, the left

hand column outlines the major aspects of the STEM topic being studied, and the right hand column documents the creative ideas that are based on a creative performance palette.

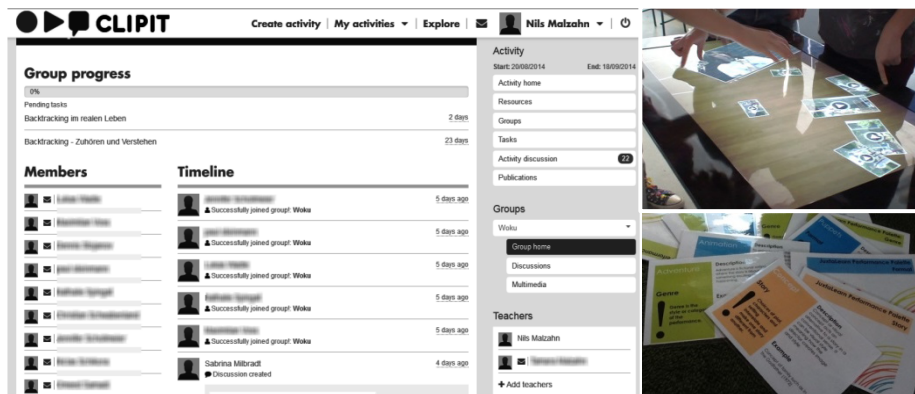


Fig. 2. Impressions from the current system: ClipIt – Group awareness (left); a pack of creative performance palette cards (bottom); a shared composition workspace on a table top (top)

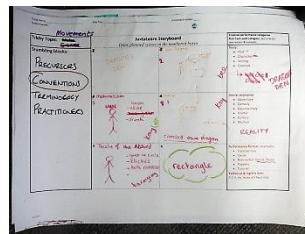


Fig. 3. Juxtalearn's storyboard – a paper version that will be adopted by a tablet or table top display providing additional scaffolds.

3 Discussion & Conclusion

Storyboards and video scripts are the essential means to JuxtaLearn's learning process. They act as boundary objects [9] that support performance and engagement. Not all students will have the same understanding of the topic or concept under study; understanding comes through discussion that these objects instigate. Furthermore, we ask the students to juxtapose their performance with the STA which triggers relational learning. By juxtaposing the STA the students need to compare and develop a deeper understanding [12], which is considered a better learning outcome. The JuxtaLearn process specifically supports students in creatively exploring a STA through metaphors and juxtaposed understandings, providing students with opportunities to compare and contrast, producing structural comparison that initiates a deeper learning [12]

by setting up conditions (e.g. forcing an “dry topic” in a drama story) in which the students have to compare their performance with the STA and have opportunities to note and reflect on subtle differences; a process that might lead to serendipitous insights and lateral thinking. Thus, students’ learning becomes transformative [13], since using imagination to define problems facilitates transformative learning. Additionally, verbalizing the learning through participating and discussing is intrinsically rewarding [14].

First trials at a UK school and Spanish university show that the JuxtaLearn approach not only stimulates targeted teaching for the students, but it also identifies the source of students’ misunderstandings by observing and automatically analyzing the discussions taking place in the reflective stages (6-8) [15].

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